



# TEMPO 1D

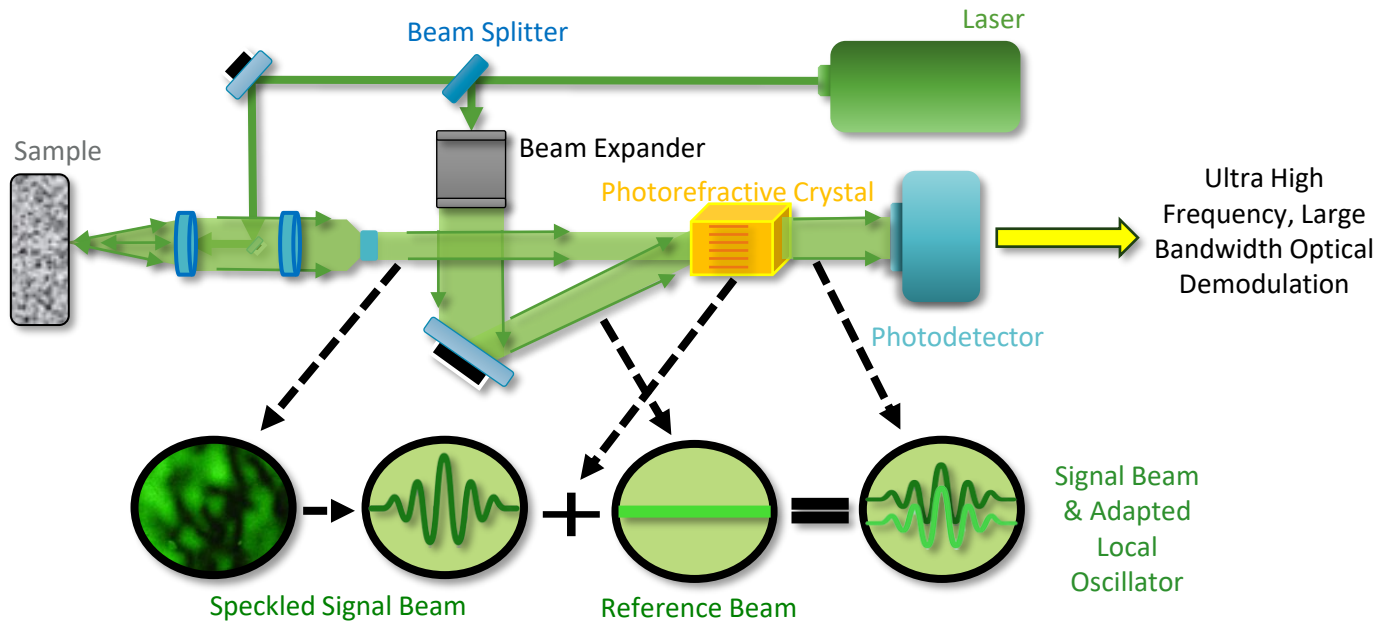
Ultra High Frequency Measurement  
All Surface Types



# Technology

## Ultra-High Frequency Interferometry

The cornerstone of the Tempo 1D's exceptional performance is the two-wave mixing (TWM) approach to laser interferometry utilizing a photorefractive crystal, offering unmatched combination of precision, adaptability, and reliability. Optimized for light-scattering surfaces, the design offers a high field of view to collect a large number of speckles. Together with its high sensitivity, it is an ideal choice for laboratory non-destructive testing.



## Adaptive Beam Splitting

In TWM, the reference and sample beams are combined in the photorefractive crystal to form a real-time hologram. The photorefractive crystal acts as an adaptive beam splitter, combining the reference and signal beams with exact wavefront matching. It compensates for slow variations in the signal beam's wavefront, crucial for maintaining accuracy in measurements. Quadrature biasing, achieved through the application of a high-voltage DC electric field, ensures linear detection of transient phase-modulated signals, enhancing the strength of real-time holograms.

## Performance and Reliability

The Tempo 1D harnesses the high-performance of photorefractive crystals, meticulously selected for their reliable properties to optimize the TWM process. Through decades of extensive research and development, photorefractive TWM has evolved into a reliable technology, guaranteeing consistent and precise measurements across a wide range of applications.

## Application Examples

This technology has been applied in various fields, including:

- Measurement of carbon fiber volume fraction within a composite laminate.  
(<https://doi.org/10.1177/00219983211011229>)
- Noncontact measurement of inner cracks in thick aluminum specimen.  
(<https://doi.org/10.1016/j.ndteint.2020.102273>)
- Fatigue crack detection.  
(<https://doi.org/10.1016/j.optlastec.2011.04.003>)
- Characterization of roll-cladded aluminum plates. (<https://doi.org/10.1115/QNDE2021-74927>)
- Online cracking detection during laser-cladding process.  
(<https://doi.org/10.1002/stc.2291>)

# Specifications

|                                                     |                                                                                     |
|-----------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>NESD (Noise Equivalent Surface Displacement)</b> | $2 \cdot 10^{-7} \text{ nm/Hz}^{1/2}$                                               |
| <b>Detection Bandwidth Upper limit</b>              | Up to 1 GHz                                                                         |
| <b>Detection Bandwidth Lower limit</b>              | 100 kHz                                                                             |
| <b>Suitable CW Laser power</b>                      | 500mW to 1.5W internal laser                                                        |
| <b>Laser wavelength</b>                             | 532nm (Visible)                                                                     |
| <b>Focusing</b>                                     | Motorized and controllable via USB                                                  |
| <b>Spot diameter on sample</b>                      | 60µm to 1.5mm (depend on stand-off)                                                 |
| <b>Optical stand-off</b>                            | 100mm, 200mm and 500mm                                                              |
| <b>Diameter of collecting aperture</b>              | 2" (50mm)                                                                           |
| <b>Depth of focus</b>                               | from 2mm to 50mm                                                                    |
| <b>Analog Outputs</b>                               | Calibrated output – 100mV/nm<br>Direct output, Calibration level and DC level       |
| <b>Options</b>                                      | 2D scanning set-up including PC, software, digitalization card and X-Y translations |
| <b>Electrical Requirements</b>                      | 110V / 220V - 50Hz / 60Hz                                                           |
| <b>Dimensions</b>                                   | 492 x 302 x 114 mm                                                                  |
| <b>Weight</b>                                       | 16kg                                                                                |

# The future is bright



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